INTERMOUNTAIN STATION
Central Reference File
No. 0.73

Forest Statistics

for

West Virginia

Northeastern Forest Experiment Station

Ralph W. Marquis, Director
Upper Darby, Pa.

Forest Service, U.S. Dept. of Agriculture

Forest Statistics Series: West Virginia No. 1

INT - FILE COPY

FOREWORD

This is the first in a new series of reports on forest areas and timber volumes in the State of West Virginia. It also shows how fast the timber in the State is growing, how much is being cut, and in general how good it is.

This report is a product of the forest survey of the Northeast, carried on by the Northeastern Forest Experiment Station as part of the Nation-wide forest survey being made by the Forest Service, U. S. Department of Agriculture.

It supersedes four preliminary statistical reports that were published in 1949 for sections of the State. The volumes in those preliminary reports were computed from standard volume tables. However, local volume tables, constructed when the survey was completed for the entire State, showed that the average tree in West Virginia has more taper than was provided for in the volume tables originally used. The preliminary volume estimates were too high. This report contains the corrected figures.

In addition, a recently completed study of log quality in West Virginia showed that some of the material that was originally included in the hardwood saw-timber volume is unsuitable for standard lumber, tie, or timber logs. The total saw-timber volume has been reduced further to correct for this.

The West Virginia Conservation Commission provided most of the aerial photographs used in this survey, and assigned a number of Commission employees to assist in carrying on the field work. Some of the aerial photographs were provided by the Monongahela National Forest.

The field work in West Virginia was supervised by Carl J. Holcomb. C. Allen Bickford developed the statistical procedures used in the survey. Computations were made under the supervision of Roland H. Ferguson.

The figures in this report are not directly comparable to previous estimates of the forest situation in West Virginia (such as those made by the Forest Service and the American Forestry Association for the "Reappraisal"of 1945). Differences between the Reappraisal estimates and these forest survey findings are explained on page 36.

Ralph W. Marquis

Ralph W. Marquis, director

CONTENTS

	Page
The forest area	1
Forest-land ownership	2
The forest types	2
Condition of the forest stands	3
Timber volume	3
Timber quality	4
Growth and drain	4
Tabular data	
Land area and forest area	5
Timber volume	12
Timber quality	18
Growth and drain	20
Appendix	
Definitions of terms	27
Forest survey methods	33
Accuracy of the estimates	34
Species tallied	34
Forest Survey vs. Reappraisal	36
National standard tables	38

Forest Statistics

for

West Virginia

by

Robert D. Wray, *forest economist*

Northeastern Forest Experiment Station
Forest Service, U.S. Dept. Agriculture

October 1952

The Forest Area

THE STATE OF WEST VIRGINIA has a total land area of nearly 15½ million acres. Sixty-four percent of this area is forested.

The commercial forest land amounts to about 10 million acres. In addition, there are 41,000 acres of forest land that are reserved from commercial logging and another 6,000 acres that are not considered capable of growing stands of commercial timber. Most of the reserved forest is in State parks; some of it is in National forests.

The mountainous, coal-mining sections in the southern and eastern parts of the State are the more heavily for-

ested. The rolling pasture land in the northwest, along the Ohio River, has much less forest area.

Forest-Land Ownership

Ninety percent of the commercial forest land is privately owned. Farmers own 33 percent; industrial and other private owners 57 percent.

More than 90,000 individuals own 77 percent of the commercial forest land. Thirty-one individuals or corporations own tracts of timberland larger than 5,000 acres; the aggregate of these holdings amounts to 13 percent of the total.

Ten percent of the commercial forest land is owned by the public. Most of this land is in the Monongahela and George Washington National Forests. The State owns 83,000 acres, largely State forest and game lands.

The Forest Types

West Virginia is hardwood country. Eighty-nine percent of the commercial forest land is covered with hardwood forest types.

The oak types are the most extensive; they occupy half the forest land. The red oak type alone takes up nearly one-third of the forested area. This type occupies nearly every kind of site, from the cool, moist bottomlands to the dry southern slopes. Many of the red oak stands are red oak only because the more desirable species such as white oak, yellow-poplar, and basswood have been removed.

The chestnut oak type and the white oak type each cover 9 percent of the forest land. Chestnut oak is commonly found on the high, dry, rocky ridges; white oak usually occupies well-drained, richer soils with a southern exposure.

Two other hardwood types occupy extensive areas in West Virginia: the yellow-poplar type (21 percent) and the sugar maple-beech-yellow birch type (15 percent). Both of these are mixtures of various hardwoods with the type-name species predominating. Both typically occupy cool, moist sites on the banks of streams or on slopes that face to the

north or east. In certain areas, yellow-poplar invades old fields along with hickory.

The softwood types cover only 11 percent of the commercial forest area. First among these is hard pine-oak, a type that occupies sites similar to the red oak and chestnut oak types. There is also some area in hard pine types, and some in spruce types.

Condition Of The Forest Stands

Only 14 percent of West Virginia's commercial forest land has stands of 5,000 board feet or more per acre. But this area contains nearly half the saw-timber volume to be found in the State. These heavier saw-timber stands average 6,100 board feet per acre.

Thirty-one percent of the commercial forest land carries stands of 1,500 to 5,000 board feet per acre.

Thirty-three percent of the area is in pole-timber stands.

The remaining 22 percent is stocked to various degrees with trees smaller than pole size. These stands have little or no commercial volume.

Timber Volume

West Virginia's commercial forests contain 17½ billion board feet of saw timber (International ¼-inch rule). More than one-fourth of this volume is red oak. In each of five other species--beech, chestnut oak, sugar maple, yellow-poplar, and white oak--there are more than a billion board feet of saw-timber volume.

Softwoods make up only about 8 percent of the total saw-timber volume.

The growing stock (all good trees more than 5.0 inches in diameter) amounts to 6.2 billion cubic feet. This volume is roughly equivalent to 77 million standard cords, including bark.

Timber Quality

U. S. Forest Products Laboratory log-grades were applied to sawlogs in hardwood saw-timber trees. Thirty-four percent of the gradable hardwood saw-timber volume in West Virginia is in Grade 2 and better standard-lumber logs; 37 percent is in Grade 3. The remaining 29 percent does not meet the requirements for standard-lumber logs, but may be used for ties or structural timbers.

Of the softwood saw timber, only white pine and the hard pines were graded. And since the sample of softwood saw timber is small, the quality data for these species are comparatively weak. The grading rules used for pine provide for three grades. (See Appendix for details of grading rules.) About 40 percent of the pine sawlog volume falls in the best two grades and 60 percent into the poorest.

Growth And Drain

In 1949, West Virginia's forests grew a total of 862 million board feet of saw timber. During this period only 574 million board feet were removed from the forest in commercial cuttings. Growth of growing stock amounted to 343 million cubic feet (about 4.3 million cords); drain was only 145 million cubic feet (about 1.8 million cords).

In all, these estimates show a favorable relationship between growth and drain. They also seem to indicate the end of the era of heavy liquidation of the forest resource. Unfortunately, however, an extensive survey of this kind cannot pinpoint the dark spots in an otherwise bright picture. For example, the survey does not show the growth-drain relationship in larger, quality timber as against that in the smaller or low-grade material. Nor can a growth-drain comparison be made between the more accessible timber land and the remote areas, or between heavy and light stands of saw timber. Volume-for-volume balance between growth and drain cannot be considered significant unless quality and accessibility are considered.

Table 1.--Land area and forest area of West Virginia, 1949

Class of land[1]	Area	
	Acres	Percent
Forest land:		
Commercial	9,859,400	64
Noncommercial		
Reserved	41,200	(2/)
Unproductive	6,100	(2/)
All forest land	9,906,700	64
Nonforest land[3]	5,504,500	36
All land[4]	15,411,200	100

[1] See Appendix for definitions.

[2] Less than 0.5 percent.

[3] Includes 75,200 acres of water according to survey standards of area classification but defined by the Bureau of the Census as land.

[4] From Areas of the United States 1950, Bureau of the Census.

Table 2.--Land area and commercial forest area of West Virginia, by counties, 1949

County	Land area	Commercial forest area	
	Acres	Acres	Percent
Barbour	215,000	77,500	36
Berkeley	202,200	79,100	39
Boone	320,700	289,600	90
Braxton	330,800	170,400	51
Brooke	57,000	23,300	41
Calhoun	179,800	111,900	62
Clay	218,900	180,100	82
Cabell	178,600	71,100	40
Doddridge	204,200	106,600	52
Fayette	421,700	349,000	83
Gilmer	217,000	110,600	51
Grant	305,300	219,800	72
Greenbrier	656,600	465,600	71
Hampshire	409,000	294,300	72
Hancock	52,500	26,200	50
Hardy	374,400	280,000	75
Harrison	267,500	62,000	23
Jackson	296,300	107,400	36
Jefferson	135,000	23,800	18
Kanawha	581,100	439,000	76
Lewis	250,900	85,800	34
Lincoln	280,300	212,600	76
Logan	291,800	253,800	87
Marion	197,800	79,100	40
Marshall	195,800	74,300	38
Mason	276,500	130,400	47
McDowell	341,100	290,700	85
Mercer	266,900	159,000	60
Mineral	211,200	139,000	66
Mingo	270,700	240,000	89
Monongalia	233,600	109,000	47
Monroe	302,700	152,900	51
Morgan	149,100	96,200	64
Nicholas	415,400	328,500	79
Ohio	68,500	21,900	32

(Continued on next page.)

Table 2, continued.

County	Land area	Commercial forest area	
	Acres	Acres	Percent
Pendleton	444,800	332,700	75
Pleasants	83,200	48,100	58
Pocahontas	603,500	464,200	77
Preston	412,800	250,900	61
Putnam	223,400	124,000	56
Raleigh	386,600	285,200	74
Randolph	663,100	528,300	80
Ritchie	289,300	142,900	49
Roane	311,000	130,300	42
Summers	229,800	154,200	67
Taylor	108,800	41,000	38
Tucker	269,400	223,000	83
Tyler	163,800	71,200	44
Upshur	225,300	102,200	45
Wayne	328,300	224,200	68
Webster	352,600	307,400	87
Wetzel	231,700	138,500	60
Wirt	149,800	76,800	51
Wood	235,500	79,700	34
Wyoming	322,600	274,100	85
Total	15,411,200	9,859,400	64

Table 3.--Ownership of commercial forest area of West Virginia, 1949

Ownership class	Commercial forest area	
	Acres	Percent
Private:		
Farm forests[1]:		
On 29,000 farms of 100 acres and more	2,417,100	25
On 40,000 farms smaller than 100 acres[2]	779,800	8
Total	3,196,900	33
Industrial and other forests:		
8 holdings of more than 50,000 acres	781,300	8
10 holdings of 25,000 to 50,000 acres	398,000	4
13 holdings of 5,000 to 25,000 acres	134,200	1
21,000 holdings smaller than 5,000 acres[3]	4,367,200	44
Total	5,680,700	57
All private (90,000 holdings)	8,877,600	90
Public:		
National forest	880,900	9
Other Federal	14,300	(4/)
State	83,200	1
County and municipal	3,400	(4/)
All public	981,800	10
Total commercial forest land	9,859,400	100

[1] Census of Agriculture, 1950.

[2] Estimated on the assumption that practically all of the 100-acre-and-larger farms contain some forest acreage.

[3] Estimated from a sample.

[4] Less than 0.5 percent.

Table 4.--Forest types on commercial forest area of West Virginia, 1949

Forest type	Commercial forest area	
	Acres	Percent
Red oak	3,207,700	32
Chestnut oak	924,200	9
White oak	887,900	9
Yellow-poplar	2,070,700	21
Sugar maple-beech-yellow birch	1,526,900	15
Aspen-pin cherry	69,200	1
Oak-white pine	62,900	1
Other hardwood types	74,100	1
Hard pine-oak	662,800	7
Pitch pine-Virginia pine	192,700	2
Spruce and spruce-hardwood	104,400	1
Other softwood types	75,900	1
All types	9,859,400	100

Table 5.--Commercial forest area of West Virginia by stand-size class and forest-type group, 1949

Forest type	Saw-timber stands		Pole-timber stands		Seedling and sapling stands	Other areas	Total commercial forest land
	More than 5,000 bd.ft. per acre	1,500-5,000 bd.ft. per acre	More than 600 cu.ft. per acre	200-600 cu.ft. per acre			
	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Oak types	480,000	1,764,900	761,700	946,900	915,900	150,400	5,019,800
Yellow-poplar	282,300	598,100	255,600	371,900	474,300	88,500	2,070,700
Sugar maple-beech-yellow birch	456,200	424,800	259,100	237,400	132,000	17,400	1,526,900
Other hardwood types	36,000	43,700	33,400	17,500	46,300	29,300	206,200
Softwood types	103,200	225,400	159,700	254,500	276,800	16,200	1,035,800
All types	1,357,700	3,056,900	1,469,500	1,828,200	1,845,300	301,800	9,859,400
Percent	14	31	15	18	19	3	100

Table 6.--Commercial forest area of West Virginia by stand-size class and watershed, 1949

Stand-size class	Watershed			Total
	Potomac River	Ohio River tributaries		
		Northern[1]	Southern[2]	
	Acres	Acres	Acres	Acres
Saw-timber stands:				
More than 5,000 bd.ft. per acre	181,800	339,000	836,900	1,357,700
1,500-5,000 bd.ft. per acre	374,900	813,100	1,868,900	3,056,900
Pole-timber stands:				
More than 600 cu.ft. per acre	308,300	453,200	708,000	1,469,500
200-600 cu.ft. per acre	323,400	455,200	1,049,600	1,828,200
Seedling and sapling stands	252,900	606,000	986,400	1,845,300
Other areas	23,600	138,800	139,400	301,800
All stands	1,464,900	2,805,300	5,589,200	9,859,400
Percent	28	57	15	100

[1]Includes the Monongahela, Little Kanawha, and Youghiogheny Rivers as well as smaller streams that flow directly into the Ohio River.

[2]The Great Kanawha and Guyondot Rivers. Also includes a small part of the James River, which is not tributary to the Ohio.

Table 7.--Net volume of live timber on commercial forest land in West Virginia, by species, 1949

Species	Growing stock		Saw timber
	Million cu.ft.	Equivalent in thousand cords[1]	Million bd.ft.[2]
Red oak	1,319	16,500	4,919
Beech	420	5,200	1,594
Chestnut oak	602	7,500	1,498
Sugar maple	337	4,200	1,211
Yellow-poplar	439	5,500	1,163
White oak	494	6,200	1,147
Hickory	451	5,600	998
Yellow birch	276	3,400	863
Basswood	213	2,700	603
Red maple	260	3,200	469
Gum	96	1,200	353
Cucumber	68	900	280
Ash	112	1,400	207
Black cherry	76	1,000	186
Other hardwood	502	6,300	586
All hardwood	5,665	70,800	16,077
Hard pines	254	3,200	589
Spruce	91	1,100	275
White pine	63	800	267
Hemlock and other softwood	101	1,300	340
All softwood	509	6,400	1,471
All species	6,174	77,200	17,548

[1] Rough, standard cords containing 80 cubic feet of solid wood.

[2] International ¼-inch rule. Saw-timber volume represents a portion of the growing stock; saw-timber volume and growing-stock are not additive.

Table 8.--Net volume of live timber on commercial forest land in West Virginia, by tree diameter, 1949

Diameter[1] (inches at breast height)	Growing stock	Saw timber
	Million cu.ft.	Million bd.ft.
Hardwood:		
6	786	--
8	925	--
10	953	--
12	589	2,487
14	555	2,739
16	480	2,594
18	407	2,298
20	310	1,817
22	229	1,374
24	150	924
26	107	672
28	81	534
30	32	216
32	20	131
34	6	42
36 and more	35	249
All hardwood	5,665	16,077
Softwood:		
6	80	--
8	102	--
10	83	306
12	74	325
14	56	254
16	34	167
18	31	152
20	12	62
22	14	74
24	3	16
26	7	40
28 and more	13	75
All softwood	509	1,471

[1] Two-inch diameter classes are used. The diameter indicated is the midpoint of the class.

Table 9.--Net volume of live timber on commercial forest land in West Virginia, by stand-size class and species group, 1949

Stand-size class and species group	Growing stock	Saw timber
	Million cu.ft.	Million bd.ft.
Saw-timber stands:		
More than 5,000 bd.ft. per acre		
Hardwood	1,815	7,511
Softwood	181	739
Total	1,996	8,250
1,500-5,000 bd.ft. per acre		
Hardwood	2,306	6,643
Softwood	153	493
Total	2,459	7,136
Pole-timber stands:		
More than 600 cu.ft. per acre		
Hardwood	804	905
Softwood	103	130
Total	907	1,035
200-600 cu.ft. per acre		
Hardwood	530	580
Softwood	57	92
Total	587	672
All other stands:		
Hardwood	210	438
Softwood	15	17
Total	225	455
All stands:		
Hardwood	5,665	16,077
Softwood	509	1,471
Total	6,174	17,548

Table 10.--Net volume of live timber on commercial forest land in West Virginia, by forest type, 1949

Forest type	Growing stock		Saw timber
	Million cu.ft.	Equivalent in thousand cords	Million bd.ft.
Red oak	1,911	23,900	5,384
Chestnut oak	543	6,800	1,570
White oak	436	5,500	1,111
Sugar maple-beech-yellow birch	1,374	17,200	4,458
Yellow-poplar	1,225	15,300	3,589
Other hardwood types	112	1,400	258
Hard pine-oak	259	3,200	514
Pitch pine-Virginia pine	135	1,700	219
Spruce and spruce-hardwood	100	1,200	259
Other softwood types	79	1,000	186
All types	6,174	77,200	17,548

Table 11.--Growing stock on commercial forest land in West Virginia, by stand-size class, 1949

Stand-size class	Saw-timber trees	Pole-timber trees	Total growing stock
	Million cu.ft.	Million cu.ft.	Million cu.ft.
Saw-timber stands:			
More than 5,000 bd.ft. per acre	1,580	416	1,996
1,500-5,000 bd.ft. per acre	1,411	1,048	2,459
Total	2,991	1,464	4,455
Pole-timber stands:			
More than 600 cu.ft. per acre	155	752	907
200-600 cu.ft. per acre	100	487	587
Total	255	1,239	1,494
All other stands	82	143	225
All stands	3,328	2,846	6,174

Table 12.--Average net volume of live timber per acre of commercial forest land in West Virginia, by stand-size class, 1949

Stand-size class (and acreage of each class)	Growing stock	Saw timber
	Cubic feet	Board feet
Saw-timber stands:		
More than 5,000 bd.ft. per acre (1,357,700 acres)	1,470	6,080
1,500-5,000 bd.ft. per acre (3,056,900 acres)	800	2,330
Pole-timber stands:		
More than 600 cu.ft. per acre (1,469,500 acres)	620	700
200-600 cu.ft. per acre (1,828,200 acres)	320	370
Other stands (2,147,100 acres)	100	210
Average, all stands (9,859,400 acres)	630	1,780

Table 13.--Quality of hardwood saw timber on commercial forest land in West Virginia, by species, 1949

Species	Standard-lumber logs		Tie and timber logs	Total
	Grades 1 & 2	Grade 3		
	Million bd.ft.	Million bd.ft.	Million bd.ft.	Million bd.ft.
Red oak	1,959	1,635	1,325	4,919
Beech	532	561	501	1,594
Chestnut oak[1]	378	632	488	1,498
Sugar maple	461	435	315	1,211
Yellow-poplar	433	406	324	1,163
White oak	413	409	325	1,147
Hickory	295	366	337	998
Basswood	231	206	166	603
Other hardwood	723	1,336	885	2,944
All hardwood	5,425	5,986	4,666	16,077
Percent	34	37	29	100

[1] Worm holes no defect.

Table 14.--Quality of softwood saw timber on commercial forest land in West Virginia, by species, 1949

Species	Log grades 1 & 2	Log grade 3	Total
	Million bd.ft.	Million bd.ft.	Million bd.ft.
Hard pines	195	394	589
White pine	136	131	267
All softwood[1]	331	525	856
Percent	39	61	100

[1] Hemlock and other softwoods were not graded.

Table 15.--Net annual growth on commercial forest land in West Virginia, by tree-size class and species group, 1949

Tree-size class and species group	Growing stock	Saw timber
	Thousand cu.ft.	Thousand bd.ft.
Saw-timber trees:		
Hardwood	155,800	792,800
Softwood	15,600	69,100
	171,400	861,900
Pole-timber trees:		
Hardwood	165,800	--
Softwood	6,200	--
	172,000	--
Saw-timber and pole-timber trees:		
Hardwood	321,600	792,800
Softwood	21,800	69,100
Total[1]	343,400	861,900

[1] The growth on growing stock is equivalent to about 4,020,000 rough standard cords of hardwood and about 272,000 rough standard cords of softwood.

Table 16.--Commodity drain on commercial forest land in West Virginia, by tree-size class and species group, 1949

Tree-size class and species group	Growing stock	Saw timber
	Thousand cu.ft.	Thousand bd.ft.
Saw-timber trees:		
Hardwood	98,000	524,300
Softwood	8,700	49,800
	106,700	574,100
Pole-timber trees:		
Hardwood	34,100	--
Softwood	4,200	--
	38,300	--
Saw-timber and pole-timber trees:		
Hardwood	132,100	524,300
Softwood	12,900	49,800
Total[1]	145,000	574,100

[1] The drain on growing stock is equivalent to about 1,651,000 rough standard cords of hardwood and about 161,000 rough standard cords of softwood.

Table 17.--Relationship of drain to growth in West Virginia, by tree-size class and species group, 1949

Tree-size class and species group	Drain as percentage of growth	
	Cubic-foot basis	Board-foot basis
	Percent	Percent
Saw-timber trees:		
Hardwood	63	66
Softwood	56	72
	62	67
Pole-timber trees:		
Hardwood	21	--
Softwood	68	--
	22	--
Saw-timber and pole-timber trees:		
Hardwood	41	66
Softwood	59	72
Total	42	67

Table 18.--Distribution of growth and drain on growing stock in West Virginia, by tree-size class and species group, 1949

Tree-size class and species group	Growth		Drain	
	Thousand cu.ft.	Per-cent	Thousand cu.ft.	Per-cent
Saw-timber trees:				
Hardwood	155,800	46	98,000	68
Softwood	15,600	4	8,700	6
	171,400	50	106,700	74
Pole-timber trees:				
Hardwood	165,800	48	34,100	23
Softwood	6,200	2	4,200	3
	172,000	50	38,300	26
Saw-timber and pole-timber trees:				
Hardwood	321,600	94	132,100	91
Softwood	21,800	6	12,900	9
Total	343,400	100	145,000	100

Table 19.--Components of net annual growth in West Virginia, by species group, 1949

Item	Softwood	Hardwood	All species
	Thousand cu.ft.	Thousand cu.ft.	Thousand cu.ft.
Growth on growing stock	20,600	260,400	281,000
Ingrowth--saplings that became pole timber in 1949	2,200	78,900	81,100
Total	22,800	339,300	362,100
Annual mortality	1,000	17,700	18,700
Net annual growth	21,800	321,600	343,400

Table 20.--Components of commodity drain on growing stock in West Virginia, 1949

Item	Percentage of total drain
	Percent
Timber products from growing stock:	
Sawlogs	49
Mine props and timbers	21
Poles and posts	4
Pulpwood	3
Fuelwood	3
Other products	1
Total output (118 million cu.ft.)	81
Logging waste of growing stock (27 million cu.ft.)	19
Total commodity drain (145 million cu.ft.)	100

APPENDIX

DEFINITIONS OF TERMS

Forest Area

Forest land area.--Includes (a) lands that are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking and which has not been developed for other use; and (c) afforested areas. (Forest tracts of less than 1 acre and isolated strips of timber less than 120 feet wide are excluded.)

Commercial forest land area.--Forest land that is (a) producing, or physically capable of producing, usable crops of wood (usually saw timber), (b) economically available now or prospectively, and (c) not withdrawn from timber utilization.

Noncommercial forest land area.--Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order, but that otherwise qualifies as commercial forest land, or (b) incapable of growing usable wood products (usually saw timber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Forest Types

Forest types are defined according to the species, or species group, that make up the major portion of the stand in terms of board feet in saw-timber stands or number of stems in other stands.

Hardwood types.--The names of these types are generally self-explanatory. "Other hardwood types" include the hardwood-spruce type and the bottomland hardwood and river birch-sycamore types.

Softwood types.--Chiefly hard-pine oak type, and some of the pitch pine-Virginia pine and spruce and spruce-hardwood types. "Other softwood types" include the hemlock type and the white pine, white pine-hardwood, and eastern redcedar types.

Stand-Size Classes

Saw-timber stands.--Stands with saw-timber trees having a minimum net volume per acre of 1,500 board feet, International ¼-inch rule.

Pole-timber stands.--Stands failing to meet the saw-timber stand specifications, but at least 10 percent stocked with pole-timber and larger trees (5.0 inches d.b.h. and larger), and with at least half of the minimum stocking in pole-timber trees. (Pole-timber stands carry at least 200 cubic feet per acre.)

Seedling and sapling stands.--Stands not qualifying as either saw-timber or pole-timber stands, but having at least 10 percent stocking of trees of commercial species and with at least half the minimum stocking in seedling and sapling trees.

Other areas.--Areas not qualifying as saw-timber, pole-timber, or seedling and sapling stands. (Includes non-stocked areas.)

Tree Classes

Saw-timber trees.--Trees of commercial species that contain at least one merchantable sawlog as defined by regional practice and that are of the following minimum diameters at breast height (d.b.h.): Softwoods 9.0 inches and hardwoods 11.0 inches. (All butt sawlogs are considered merchantable. Where the butt is defective, upper sawlogs are considered merchantable if they account--in terms of aggregate net volume--for 50 percent or more of the gross volume below the top of the uppermost sawlog. A sawlog is a portion of a live tree that meets the minimum log-grade specifications, as explained under "timber quality".)

Pole-timber trees.--Trees 5.0 inches d.b.h. and larger of commercial species that do not meet the specifica-

tions for saw-timber trees but do meet regional specifications of species, soundness, and freedom from defect. (These are the trees that are straight and clear enough to make saw-timber trees eventually.)

Seedling and sapling trees.--Trees of commercial species less than 5.0 inches in diameter at breast height.

Cull trees.--Live trees of saw-timber or pole-timber size that are unmerchantable for sawlogs now or prospectively because of defect, rot, or species.

Timber Volume

Growing stock.--Net volume, in cubic feet, of live saw-timber trees and live pole-timber trees from stump to a minimum 4.0-inch top (of central stem) inside bark.

(This volume is also given in rough, standard cords, bark included. Cord volume is derived from cubic-foot volume by applying a factor of 80 cubic feet per cord.)

Live saw-timber volume.--Net volume in board feet, International $\frac{1}{4}$-inch rule, of live saw-timber trees. (This includes only the net volume of sawlogs, i.e., logs that meet the minimum quality standards defined below. Saw-timber volume is measured in 16-foot logs except that the uppermost log may be as short as 8 feet.)

Timber Quality

Hardwood standard-lumber log grades.--Grade 1 logs are hardwood logs that yield about two-thirds of their volume as No. 1 Common and better standard lumber. Grade 2 logs yield less than one-half and Grade 3 logs about one-fifth in No. 1 Common and better. Grading specifications (fig. 1) used are based on the hardwood log grades developed by the U. S. Forest Products Laboratory.[1]

[1] U.S. FOREST PRODUCTS LABORATORY. HARDWOOD LOG GRADES FOR STANDARD LUMBER. PROPOSALS AND RESULTS. U.S. FOREST PROD. LAB. RPT. D1737. 15 PP., ILLUS. MADISON, WIS. 1949.

HARDWOOD LOG GRADES FOR STANDARD LUMBER

GRADE FACTORS*		SPECIFICATIONS							
		Log Grade 1			Log Grade 2				Log Grade 3
Position in tree		Butts only	Butts & uppers		Butts & uppers				Butts & uppers
Scaling diameter (inches)		[1]13-15	16-19	20+	[2]11	12+			8+
Length, without trim (feet)		10+	10+	10+	10+	8-9	10-11	12+	8+
Clear cuttings** on each of 3 best faces	Min. length (feet)	7	5	3	3	3	3	3	2
	Max. number	2	2	2	2	2	2	3	--
	Min. yield in face length	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Max. sweep allowance (percent of gross volume)		15			30				50
Max. cull and sweep allowance (percent of gross volume)		[3]40			[4]50				50

*End defects, although not visible in standing trees, are important in grading cut logs. Instructions for dealing with this factor are contained in Forest Prod. Lab. Rpt. D1737.

**A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth the surface of the log as divided lengthwise.

[1]Ash and basswood butts can be 12 inches if otherwise meeting requirements for small No. 1's.

[2]10-inch logs of all species can be No. 2 if otherwise meeting requirements for small No. 1's.

[3]Otherwise No. 1 logs with 51-60 percent cull can be No. 2.

[4]Otherwise No. 2 logs with 51-60 percent cull can be No. 3.

Figure 1

Hardwood tie and timber logs.--Hardwood logs suitable for ties and construction timbers but not for standard lumber. The minimum specifications (fig. 2) are based on log grades developed by a Forest Service committee in the South.[2]

Softwood log grades.--The grades used for hard pine logs are derived from grades developed by the Southern Forest Experiment Station. The grades used for white pine are similar to those developed by the Northeastern Timber Salvage Administration, U. S. Forest Service. Both systems provide for three grades. In this report Grades 1 and 2 are combined.

For the hard pines, Grade 2 and better logs are expected to yield 10 percent or more of B and better lumber or 50 percent or more of B and better and No.1 Common combined.

For white pine, Grade 2 and better logs are expected to yield 10 to 30 percent of No. 1 Common and better, 25 to 50 percent of No. 2 Common and better, and the rest in the lower lumber grades. These percentages are merely rough indicators and must not be taken as precise.

Hemlock, spruce, and other softwoods are not graded here. In general, for these species, the entire bole to a 6-inch top is considered merchantable. However, deductions are made for rot and defect.

Growth And Drain

Net annual growth of saw timber.--The change during a specified year in net board-foot volume of live saw timber on commercial forest land resulting from natural causes exclusive of catastrophic losses.

Net annual growth of growing stock.--The change during a specified year in net cubic-foot volume of growing stock on commercial forest land resulting from natural causes exclusive of catastrophic losses.

---

[2] SOUTHERN FOREST EXPERIMENT STATION. INTERIM LOG GRADES FOR SOUTHERN HARDWOODS. SOUTH. FOREST EXPT. STA. 9 PP. NEW ORLEANS. 1948.

HARDWOOD LOG SPECIFICATIONS FOR TIES AND TIMBERS

GRADE FACTORS		SPECIFICATIONS
Position in tree		Butts and uppers
Scaling diameters (inches)		8+
Length, without trim (feet)		8+
Clear cuttings		No requirements: not graded on cutting basis.
Max. sweep allowance		One-fourth d.i.b. of small end for half logs, and one-half d.i.b. for logs 16 feet long.
Sound surface defects	Single knots	Any number, if none has an average collar * diameter that is more than one-third of log diameter at point of occurrence.
	Whorled knots	Any number, provided the sum of the collar diameters does not exceed one-third the log diameter at point of occurrence.
	Holes	Any number not exceeding knot specifications if they do not extend more than 3 inches into the contained tie or timber.
Unsound surface defects**	Any number and size if they do not extend into contained tie or timber. If they extend into contained tie or timber, they shall not exceed size, number, and depth of limits for sound knots.	

*Knot collar is the average of the vertical and horizontal diameters of the limb or knot swelling as measured flush with the surface of the log.

**Interior defects are not visible in standing trees. They are considered in grading cut logs. No interior defects are permitted except one shake not more than one-third the width of the contained tie or timber, and one split not more than 5 inches long.

Figure 2

Commodity drain on live saw timber.--The board-foot volume of live saw-timber trees removed from commercial forest land during a specified year as timber products and logging waste.

Commodity drain on growing stock.--The cubic-foot volume of live saw-timber and pole-timber trees removed from commercial forest land during a specified year as timber products and logging waste.

FOREST SURVEY METHODS

Estimates of forest area, timber volume, and tree growth in West Virginia are based on data obtained from sample plots that were first located on aerial photographs. These plots were distributed uniformly over the entire State. Trained photo interpreters examined the photos and classified each forest plot according to stand size. Field crews then inspected enough plots on the ground to attain a specified level of statistical accuracy. Species, volume, growth, and quality data were collected on these ground plots.

The survey was designed for maximum accuracy in the estimate of total cubic volume of growing stock.

Growth was computed from measurements of tree rings on increment cores taken from sample trees. These data were used in estimating the diameter distribution of each species 10 years hence. Future volume was predicted from this new distribution of diameters. Growth was then determined by subtracting present volume from estimated future volume and reducing the difference to an annual basis. Allowances were made for mortality, ingrowth, and drain.

Drain estimates were derived from production data supplied by the State Forester and the Bureau of the Census, supplemented by special studies of fuelwood and fence-post production and of logging waste.

ACCURACY OF THE ESTIMATES

The estimates in this report may contain two kinds of error. First, photo interpreters may make mistakes in judgment and fieldmen may make mistakes in measuring or recording. There is no practical way of finding out just how often such errors occur. But they are kept to a minimum by closely checking all phases of the work.

The second kind of error is associated with sampling procedures. The size of this error can be measured. In West Virginia, the chances are 2 to 1 that the sampling error will not exceed 0.7 percent of the total forest area, 2.7 percent of the total saw-timber volume, 2.0 percent of the total growing stock, or 2.5 percent of the total cubic-foot growth.

These percentages show that the area estimates are more reliable than the volume estimates, and that the cubic-foot estimates are more reliable than the board-foot estimates.

In each of the tables, the total figures are more reliable than the subtotals. The subtotals are more reliable than any of the individual figures. Figures that are small in relation to totals are subject to larger sampling errors.

SPECIES TALLIED

The various commercial tree species tallied in West Virginia are listed below .[3] Approved common names are shown in parentheses if these differ from the brief name used in the tables.

[3] U.S. FOREST SERVICE. CHECK LIST OF THE NATIVE AND NATURALIZED TREES OF THE UNITED STATES INCLUDING ALASKA. U.S. FOREST SERVICE. 325 PP. 1949.

Hardwoods

Red oak (Northern red oak)	- Quercus borealis
(Black oak)	- Quercus velutina
(Scarlet oak)	- Quercus coccinea
Beech (American beech)	- Fagus grandifolia
Chestnut oak	- Quercus montana
Sugar maple	- Acer saccharophorum
Yellow-poplar	- Liriodendron tulipifera
White oak	- Quercus alba
Hickory	- Carya species
Yellow birch (Yellow birch)	- Betula lutea
(Sweet birch)	- Betula lenta
Basswood (American basswood)	- Tilia americana
Red maple	- Acer rubrum
Gum (Blackgum)	- Nyssa sylvatica
Cucumber (Cucumbertree)	- Magnolia acuminata
Ash	- Fraxinus species
Black cherry	- Prunus serotina
Other hardwoods	
(Black walnut)	- Juglans nigra
(Black locust	- Robinia pseudoacacia
(Elm)	- Ulmus species
(Butternut)	- Juglans cinerea
(American sycamore)	- Platanus occidentalis
(Yellow buckeye)	- Aesculus octandra
(Ohio buckeye)	- Aesculus glabra
(Kentucky coffeetree)	- Gymnocladus dioicus
(Hackberry)	- Celtis occidentalis
(Bigtooth aspen)	- Populus grandidentata
(Quaking aspen)	- Populus tremuloides
(Honeylocust)	- Gleditsia triacanthos
(Silver maple)	- Acer saccharinum
(River birch)	- Betula nigra
(Black willow)	- Salix nigra

Softwoods

Hard pine (Pitch pine)	- Pinus rigida
(Virginia pine)	- Pinus virginiana
Hemlock (Eastern hemlock)	- Tsuga canadensis
Spruce (Red spruce)	- Picea rubens
(Black spruce)	- Picea mariana
White pine (Eastern white pine)	- Pinus strobus
Other softwoods	
(Eastern redcedar)	- Juniperus virginiana
(Table mountain pine)	- Pinus pungens

FOREST SURVEY vs. REAPPRAISAL

In 1945 the U. S. Forest Service published somewhat similar estimates of forest areas, timber volumes, and growth in West Virginia, as part of a Nation-wide reappraisal of the forest resource.[4] Differences exist between the "Reappraisal" estimates and the forest survey estimates in this report (table 21).

If the figures in this report are compared with the "Reappraisal" estimates, here are some points to keep in mind:

- Previous estimates were based largely upon general knowledge and the judgment of informed persons. The accuracy of such estimates cannot be controlled. Accuracy of the present survey is controlled by scientific survey design.
- Some specifications used in this report are different from specifications used in previous estimates.
- Changes in forest conditions in West Virginia cannot be measured by comparing this report with previous estimates.
- Valid comparisons of changing forest conditions in West Virginia will be possible when the same area is resurveyed in the future.

[4] U.S. FOREST SERVICE. BASIC FOREST STATISTICS FOR THE UNITED STATES. PRELIMINARY DATA FROM THE REAPPRAISAL PROJECT. U.S. FOREST SERVICE. 14 PP. 1946.

Table 21.--Comparison of Forest Survey findings in West Virginia with Reappraisal estimates

Item	Forest Survey estimate (1949)	Survey sampling error	Reappraisal estimate (1945)	Relationship of Reappraisal estimate to Survey estimate
				(+ High) (- Low)
	Thousand acres	Per-cent	Thousand acres	Per-cent
Commercial forest area in--				
Saw-timber stands	4,415	—	4,213	- 4.6
All other stands	5,445	--	5,639	+ 3.6
Total	9,860	0.7	9,852	- 0.1
	Million bd.ft.		Million bd.ft.	
Sawlog volume in--				
Saw-timber stands	15,386	--	8,140	- 47.1
All other stands	2,162	—	643	- 70.3
Total	17,548	2.7	8,783	- 49.9
	Million cu.ft.		Million cu.ft.	
Growing stock volume in--				
Saw-timber trees	3,328	--	2,295	- 31.0
Pole-timber trees	2,846	--	2,316	- 18.6
Total	6,174	2.0	4,611	- 25.3
	Million bd.ft.		Million bd.ft.	
Net annual growth in--				
Saw-timber trees	862	—	449	- 47.9
	Million cu.ft.		Million cu.ft.	
Growing stock	343	2.5	241	- 29.7

NATIONAL STANDARD TABLES

The following tables will be found in all forest survey state or subregional reports to enable readers to combine or compare the data with similar data for other areas and to facilitate national compilations.

National Standard Table 1.--Land area by major classes of land. West Virginia, 1949

Class of land	Area
	Thousand acres
Forest:	
Commercial	9,860
Noncommercial:	
Reserved from commercial timber use	41
Unproductive for timber use[1]	6
Total	9,907
Nonforest[2]	5,504
Total, all classes	15,411

[1] None withdrawn for special uses.

[2] Includes 75,000 acres of water according to Survey standards of area classification but defined by the Bureau of Census as land.

National Standard Table 2.--Commercial forest-land area by ownership class and stand-size class. West Virginia, 1949

Ownership class	Total	Saw-timber stands	Pole-timber stands	Seedling & sapling stands	Nonstocked & other areas[1]
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Public[2]	982	421	420	128	13
Private	8,878	3,994	2,878	1,717	289
All ownerships	9,860	4,415	3,298	1,845	302

[1] Includes areas not elsewhere classified.

[2] Chiefly in the Monongahela National Forest. Additional breakdown of public ownership by stand-size not warranted by data obtained from the Forest Survey.

National Standard Table 3.--Area of commercial forest land by major forest types, West Virginia, 1949

Forest type	Area
	Thousand acres
White-red-jack pine[1]	71
Spruce-fir	104
Loblolly-shortleaf pine[2]	861
Oak-hickory[3]	7,154
Elm-ash-cottonwood	27
Maple-beech-birch[4]	1,574
Aspen-birch	69
Total	9,860

[1] Includes hemlock type.

[2] Includes small area of eastern redcedar type.

[3] Includes oak-white pine and yellow-poplar types.

[4] Includes hardwood-spruce type.

National Standard Table 4.--Net volume of live saw timber and growing stock on commercial forest land by stand-size class. West Virginia, 1949

Stand-size class	Saw timber	Growing stock
	Million bd.ft.	Million cu.ft.
Saw-timber stands	15,386	4,455
Pole-timber stands	1,707	1,494
Seedling and sapling stands	431	204
Nonstocked and other areas not elsewhere classified	24	21
Total	17,548	6,174

National Standard Table 5.--Net volume of live saw timber and growing stock on commercial forest land by ownership class. West Virginia, 1949

Ownership class[1]	Saw timber	Growing stock
	Million bd.ft.	Million cu.ft.
Federally owned or managed[2]	1,205	523
State, county, and municipal[3]	109	44
Private:		
Farm	4,165	1,630
Industrial and other	12,069	3,977
Total private	16,234	5,607
All ownerships	17,548	6,174

[1] Additional break-down into subclasses not warranted by data obtained from the Forest Survey.

[2] Chiefly National forest.

[3] Chiefly State.

National Standard Table 6.--Net volume of live saw timber and growing stock on commercial forest land by species. West Virginia, 1949

Species[1]	Saw timber	Growing stock
	Million bd.ft.	Million cu.ft.
Softwoods:		
Southern yellow pines[2]	589	254
Spruce	275	91
White pine	267	63
Other eastern softwoods[3]	340	101
Total	1,471	509
Hardwoods:		
White oak[4]	1,147	494
Red oak[5]	3,419	917
Other white oaks	1,498	602
Other red oaks	1,500	402
Yellow birch	863	276
Sugar maple	1,211	337
Soft maples	469	260
Beech	1,594	420
Blackgum	353	96
Ash	207	112
Hickory	998	451
Basswood	603	213
Yellow-poplar	1,163	439
Other eastern hardwoods	1,052	646
Total	16,077	5,665
All species	17,548	6,174

[1] Species from the national standard list that do not appear here are either not present in West Virginia or were found so infrequently that no reliable estimate of volume could be made.

[2] Pinus rigida and P. virginiana.

[3] Chiefly hemlock.

[4] Quercus alba only.

[5] Q. borealis only.

National Standard Table 7.--Net volume of live saw timber on commercial forest land, by diameter class groups and species.

West Virginia, 1949

Species	Diameter-class groups						
	10	12	14	16	18	20 and more	Total
	-----Million board feet-----						
Southern yellow pines	154	167	145	53	42	28	589
White pine	31	33	16	36	28	123	267
Other eastern softwoods[1]	121	125	93	78	82	116	615
Total	306	325	254	167	152	267	1,471
White oak[2]	--	273	242	169	150	313	1,147
Red oak[3]	--	463	590	571	528	1,267	3,419
Other white oaks	--	237	206	226	209	620	1,498
Other red oaks	--	203	265	246	229	557	1,500
Yellow birch	--	59	104	106	89	505	863
Sugar maple	--	89	123	150	166	683	1,211
Beech	--	170	201	295	224	704	1,594
Blackgum	--	39	68	75	76	95	353
Yellow-poplar	--	236	263	185	173	306	1,163
Other eastern hardwoods	--	718	677	571	454	909	3,329
Total	--	2,487	2,739	2,594	2,298	5,959	16,077
All species	306	2,812	2,993	2,761	2,450	6,226	17,548

[1] Chiefly hemlock and spruce.

[2] Quercus alba only.

[3] Q. borealis only.

National Standard Table 8.--Net volume of all timber on commercial forest land, by class of material and species group. West Virginia, 1949

Class of material	Total	Softwoods	Hardwoods
	Million cu.ft.	Million cu.ft.	Million cu.ft.
Growing stock:			
Saw-timber trees:			
Sawlog portion	3,025	304	2,721
Upper stem portion	303	23	280
Total	3,328	327	3,001
Pole-timber trees	2,846	182	2,664
Total growing stock	6,174	509	5,665
Other material:			
Sound cull trees	179	12	167
Rotten cull trees	694	4	690
Salvable dead trees[1]	220	--	220
Total other material[2]	1,093	16	1,077
Total, all timber	7,267	525	6,742

[1] Includes only chestnut saw-timber trees.

[2] The net volume in hardwood limbs is negligible.

National Standard Table 9.--Net annual growth, annual mortality, and commodity drain on live saw timber and growing stock on commercial forest land, by species groups, West Virginia, 1949

Item	Saw timber			Growing stock		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million board feet			Million cubic feet		
Net annual growth	862	69	793	343	22	321
Annual mortality	72	2	70	19	1	18
Commodity drain						
Timber products	510	45	465	118	10	108
Logging waste	64	5	59	27	3	24
Total	574	50	524	145	13	132

National Standard Table 10.--Total output of timber products and commodity drain on live saw timber and growing stock. West Virginia, 1949

Product	Volume of products cut[1]			Commodity drain on saw timber			Commodity drain on growing stock		
				Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total
	Standard units	Number of units	M cu.ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Sawlogs	M bd.ft.[2]	483,900	76,600	46	470	516	10	84	94
Veneer logs and bolts	do.	7,000	1,100	--	8	8	--	1	1
Cooperage logs and bolts	do.	6,700	1,100	--	7	7	--	1	1
Pulpwood bolts	Stand.cords[3]	51,900	4,200	4	6	10	2	2	4
Fuelwood	do.	48,800	3,900	--	3	3	(4/)	4	4
Posts[5]	M pieces	5,300	5,300	(4/)	9	9	(4/)	5	5
Round mine timbers	M cu.ft.	31,100	31,100	(4/)	19	19	1	34	35
Miscellaneous[6]	do.	1,200	1,200	--	2	2	--	1	1
Total[7]	--	--	124,500	50	524	574	13	132	145

[1] Includes material from both growing stock and other miscellaneous sources.

[2] International 1/4-inch rule.

[3] Rough wood basis.

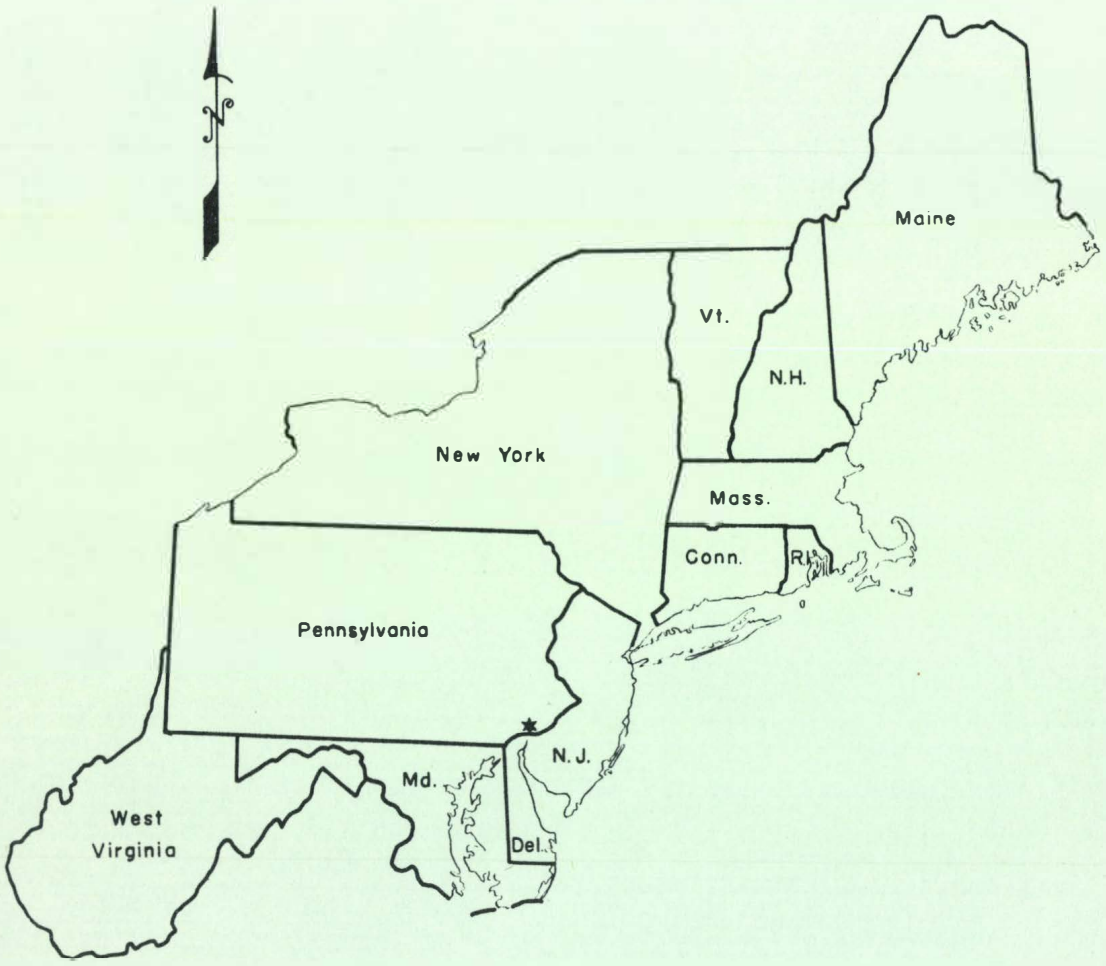
[4] Less than 500,000.

[5] Includes small volume of poles and piling.

[6] Includes chemical wood, excelsior, handle stock, shingle bolts, etc.

[7] No pulpwood logs or hewn ties separately reported.

AGRICULTURE - FOREST SERVICE - UPPER DARBY, PA.



TERRITORY SERVED
by the
NORTHEASTERN FOREST
EXPERIMENT STATION

UPPER DARBY, PA.